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(54) Testing test fixtures for pcb's

(57) Apparatus to electrically inspect fixtures used for the testing of unassembled or assembled printed circuit boards comprises an inspection probe (21) for contacting the test probes (13) installed in the test fixture (15). The inspection probe is positioned by a driver (20) over a particular test probe under computer control, the computer using the same data for the control of the inspection probe as was used for the intial fixture wiring process. The probe being caused to connect to specific test probes in turn. An electrical inspection of the test fixture wiring may therefore be made without reliance upon manual skills.

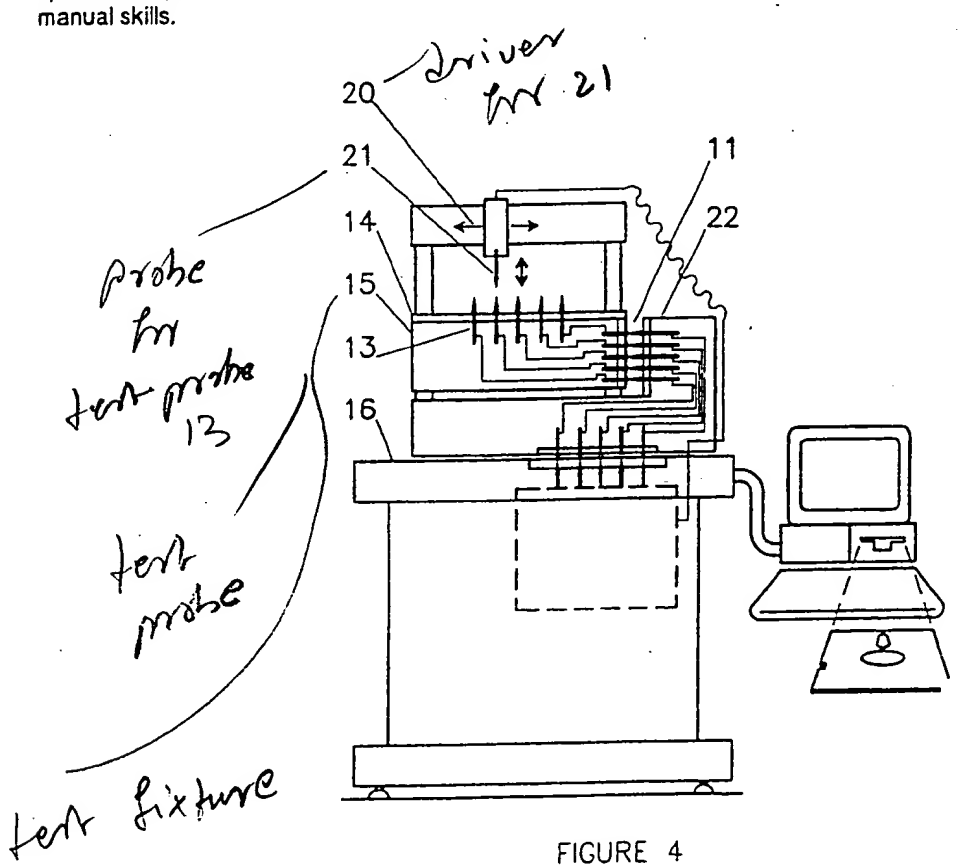

FIGURE 4

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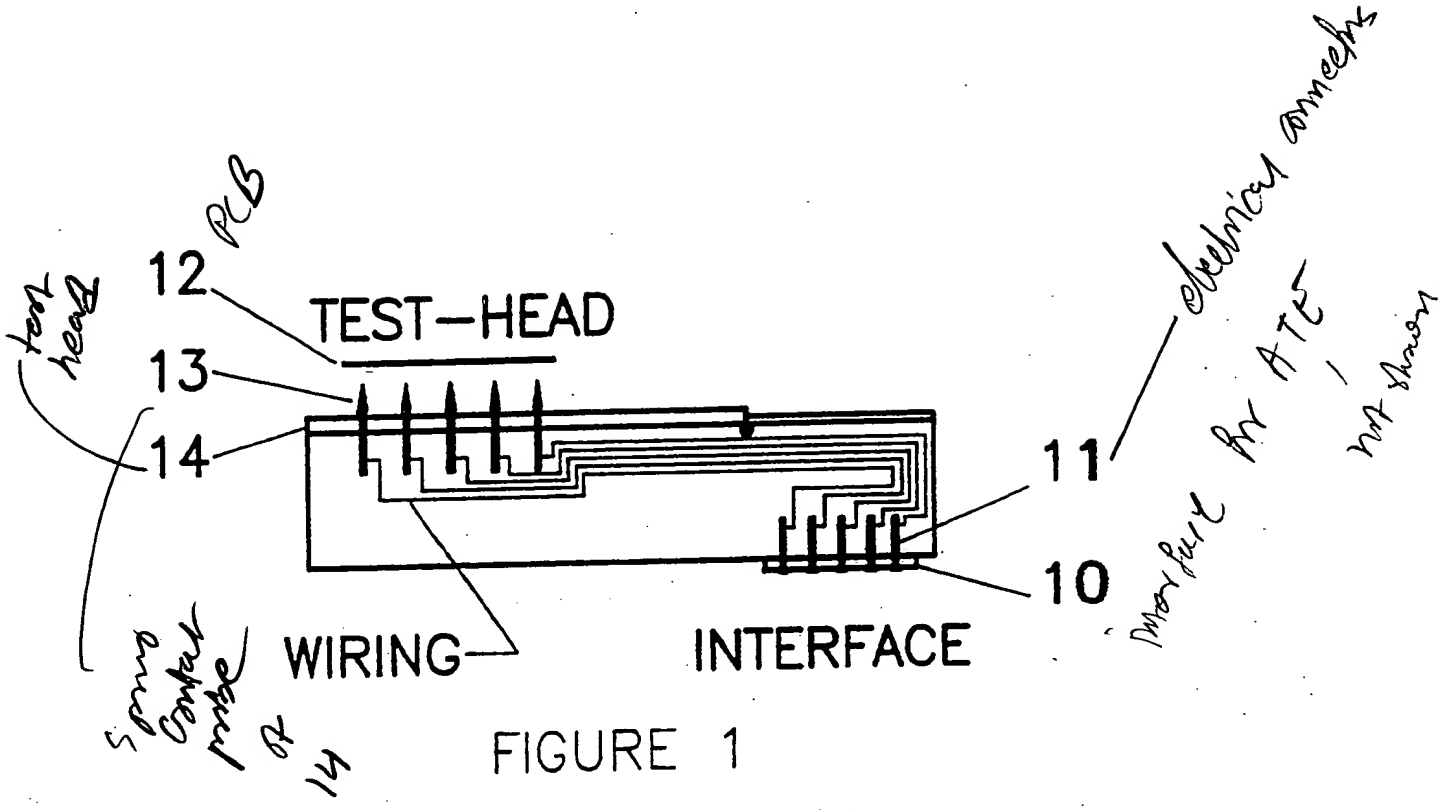

FIGURE 1

(Prior Art)

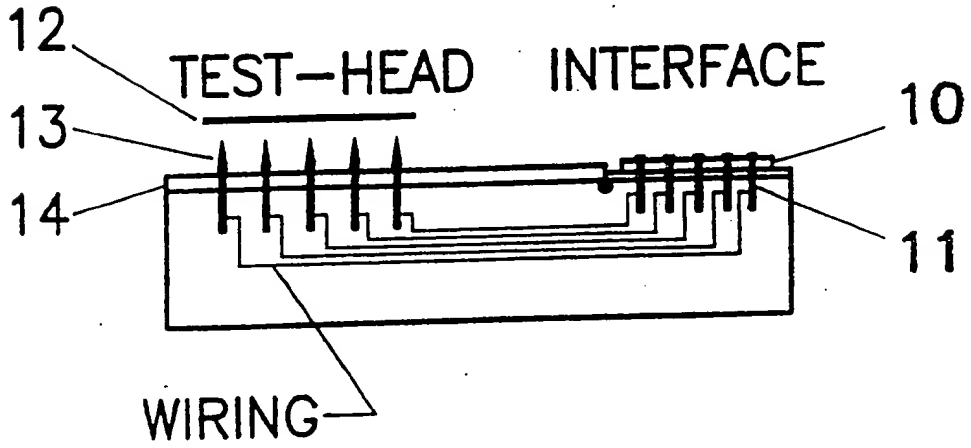

FIGURE 2

(Prior Art)

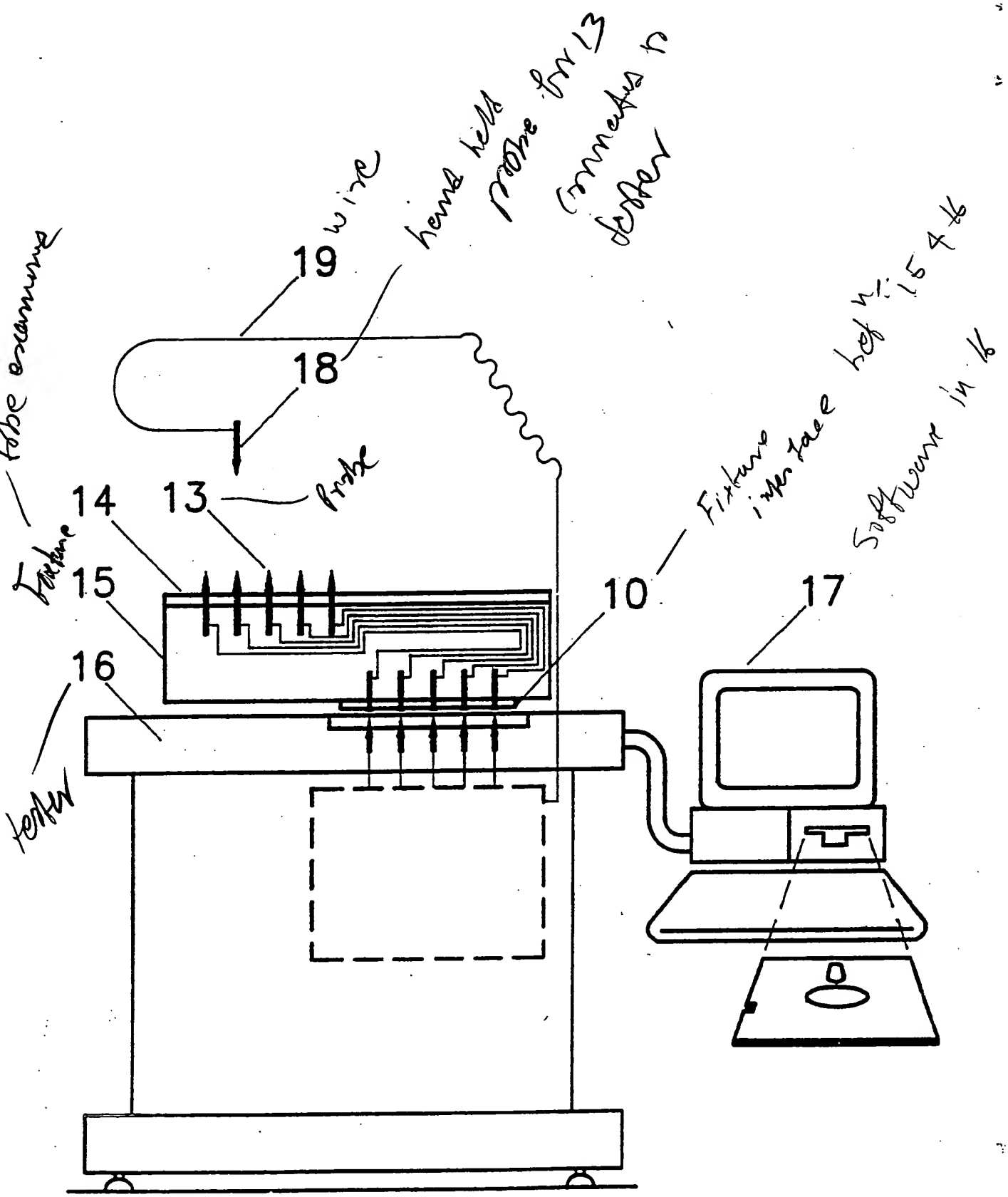

FIGURE 3

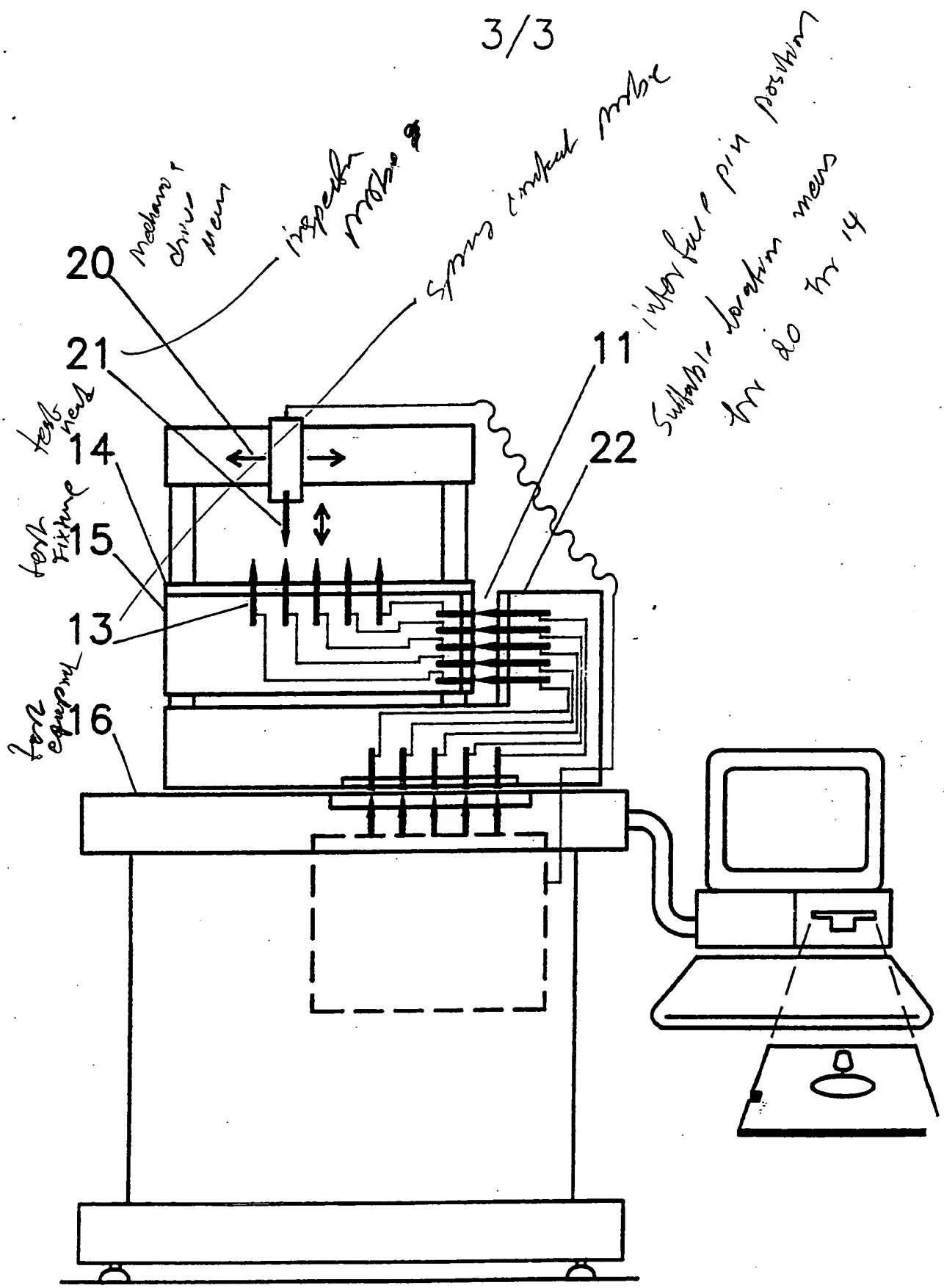

FIGURE 4

WIRING TESTING APPARATUS

This invention relates to equipment used to inspect test fixtures as used on automatic test equipment for the purpose of electrically testing unassembled or assembled printed circuit boards.

Automatic test equipment (ATE) used for the testing of assembled printed circuit boards (pcbs) generally requires some form of test fixture in order to make contact between the ATE and the particular pcb or unit under test (UUT). The ATE will then use computer software called a test program, combined with the electronic circuitry of the ATE, to perform the required test. Known types of test fixture may take the form of two electrical interfaces joined by wiring, two known configurations being shown in figures 1 and 2.

The interface which makes contact with the ATE, called the fixture interface 10, comprises a uniform array of electrical connectors 11 mounted in some mechanical arrangement which allows the connectors 11 to make an electrical connection with the mating part of the ATE, generally known as the ATE receiver (not illustrated). The interface which makes contact with the pcb 12 usually comprises a number of spring contact probes 13 installed in positions to suit the particular design of the pcb 12 being tested and is referred to as the test head 14. This includes known means to align the pcb 12 with the spring contact probes 13 and to cause the pcb to be pressed down uniformly against the probes.

The test program which runs the ATE may determine the exact electrical pattern in which points at the fixture interface 10 are to be wired to the spring contact probes 12 in the test head 14. In this case the fixture is known as specifically wired. If the ATE is capable of testing a pcb using a fixture which has not been specifically wired and generating a test program to suit, then the fixture is generally referred to as randomly wired.

of wiring, be examined electrically using a suitable test system. Such a test will verify the interconnection pattern between each point on the interface and points on the test head, refer to figure 3. This may be carried out as follows:

The fixture 15 to be examined is electrically connected to the tester 16 by means of the fixture interface 10.

Suitable operating software 17 is loaded into the tester 16.

The tester will prompt the operator to touch each probe 13 in turn on the fixture test head 14 with a hand held probe 18 connected by suitable electrical means 19 to the tester 16.

The test software will record which positions on the fixture interface 10 are connected to each test head probe 13, and thus build up a pattern of interconnections, which are generally displayed in ascending interface pin order. This data will generally be stored electronically and may in addition be produced in the form of a physical listing on paper.

It is also known that the probe positions may, instead of being recorded simply as numbers, be allocated a text name corresponding to the name of the particular device on the printed circuit board which that probe in the fixture is designed to contact. Such a file of data when completed is generally known as a translation table, and serves to identify the fixture interconnections in terms of the pcb components and the interface pin numbers. Further, it is known that for printed circuit boards designed and manufactured by computer aided means, the spatial location of any node on the pcb may also be recorded relative to some datum , which may or may not itself be bounded by the outline of the printed circuit board.

A node position on the test head may then be defined in four ways:

A test point number.

An interface channel number.

A name corresponding to the pcb component at that position.

A spatial co-ordinate reference relative to some datum position.

Whatever means is used to present the completed test data, prior art requires that when electrically testing a completed test fixture, at some stage an operator must, prompted by the test software, manually contact each probe in turn. This process is slow and liable to error since the test software must specify the point to be probed by name or co-ordinate means. The operator must then find the point required by the test software by visual means. Failure to contact the correct point with the find point probe will result in a spurious error report.

According to the invention there is provided a means by which a test fixture, either randomly or specifically wired, may be electrically examined without reliance upon operator intervention. In particular the invention provides a means whereby the test process may use the same wiring data to test the fixture that was used to wire the fixture initially, subject to the test data including spatial co-ordinates relating to component positions on the printed circuit board.

In the preferred embodiment of the invention, figure 4, a test fixture 15 is electronically connected to test equipment 16 including operating software which can recognise the desired fixture wire pattern stored in electronic form. A mechanical drive means 20 is then placed over the test fixture 15. The function of the drive means 20 is to position an inspection probe 21 above any desired spring contact probe 13 and, having situated the inspection probe in the correct position, cause the inspection probe to make electrical contact with the spring contact probe. A suitable location means 22 is

provided so that the mechanical drive means 20 is ref. to the test head 14 in such a way that component co-ordinate positions specified in the test data shall, when used as a source of data for control of the inspection probe 21, cause the inspection probe to be positioned by the mechanical drive means directly above the spring contact probe 13 which is installed in the test head in the position corresponding to that particular component position on the printed circuit board when installed on the completed test fixture. The co-ordinate system used would ordinarily be of cartesian form, but might be of polar form or any other form so long as the data used for both the initial wiring and subsequent testing of the fixture are compatible.

In the preferred embodiment of the invention using the apparatus described above and illustrated in figure 4, the test fixture 15 may then be inspected in the following manner. The tester 16 selects the test probe position 13 which should be connected to the lowest numbered interface pin position 11. The inspection probe having been caused to make contact with that test probe, the automatic test equipment 16 then scans every interface pin position in sequence to verify that the electrical interconnection pattern between the particular probe 13 and fixture interface 10 is identical to that specified in the original test data. Such interconnection may be singly to the particular interface pin as in the case of one wire, or to multiple interface pins in the case of either multiple wires terminated at the probe, or additional wires linking two or more pins at the interface. By examining every specified probe position and corresponding interface connections a complete wiring pattern can be built up and compared for errors with the theoretical test pattern.

A test as described above will by means of the invention, without operator involvement, and at a speed greater than that achievable manually,

either short or open circuits. One error which will not be detected other than by inference from reports of missing wires is the condition wherein a probe has been installed in the wrong physical location. Using an automatic or semi-automatic wiring means at time of manufacture would detect such a fault prior to completion, however if a fixture is wired entirely by visual and manual means, then such an error can remain undetected until the fixture is tested. If such a probe is wired to a single interface pin, then when that pin is examined and the corresponding test probe position reported as open circuit by the invention, then the nature of the open circuit must be examined manually. To assist in this process the equipment described in the preferred embodiment of the invention may be augmented by a printing means whereby a full size pattern of all specified probe positions may be drawn onto transparent material, which is referred to generally as a probe plot. Manually placing the probe plot over the fixture will enable the operator to determine that each specified position has a probe installed, and that there are no probes installed in unspecified positions. Such a process is very quick and may be carried out as a standard precaution prior to the inspection according to the invention.

Several types of test fixture may benefit from application of the invention:

Manually wired fixtures to a specific pattern may be checked for wiring accuracy and abscence of opens/shorts.

Auto wired fixtures may be checked out using the same program as that used to wire the fixture to detect opens or shorts.

Randomly wired fixtures may be buzzed out to establish the pattern used, and print out the resulting node map and network list.

1 Apparatus with which the wiring of a test fixture for the testing of unassembled or assembled printed circuit boards may be electrically examined by simultaneously using a known means of automatic test equipment which interfaces electrically to the fixture interface, combined with an inspection probe positioned by electromechanical drive means for the purpose of making connection with the test probes installed in the test head of the fixture, thereby verifying the wiring pattern of the test fixture by computer controlled means and without operator intervention.

2 An inspection means as claimed in claim 1 where the test fixture being inspected has been manufactured by automatic wiring methods.

3 An inspection means as claimed in claim 1 where the test fixture being inspected has been manufactured by manual wiring methods.

4 An inspection means as claimed in claim 2 or 3 where the test fixture being inspected has been randomly wired.

5 An inspection means as claimed in claim 1 where the inspection probe drive means is other than electromechanical and may for example be by pneumatic, hydraulic or magnetic means.

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